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ORIGINAL ARTICLES.

CASES OF OPHTHALMIA NEONATORUM.[1]

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I DO NOT claim anything new or rare in reporting these cases, because they are quite common in all our large cities. The chief object in reporting these cases is to show that by careful examination of the discharge from the eyes, a great many cases are found not due to gonorrhœa; also when the gonococci were found in the eye discharge, the disease lasted longer and was much harder to treat. And in some cases in which no gonococci were found, the disease was made worse by improper previous treatment, and rapidly got well under proper and milder treatment, in less than half the time.

The chief characteristics, or the ones that I depend my diagnosis on in making microscropical examinations is not only the shape and size of the diplococci, and that I find them inside of the cell surrounding the nucleus or inside of the pus-cell, but chiefly on their not taking on the staining by Gram's method, as we have quite a number of diplococci that are nearly of the same size and shape, which are sometimes found inside of the cell surrounding the nucleus, either by accident or not. But every one of these diplococci is stained by the Gram method, while the gonococci are not stained by that method.

[1]Read at the Second Annual Meeting of the Western Ophthalmological, Otological, Laryngological and Rhinological Association, held in St. Louis, April 8–9, 1897.

CASES OF OPHTHALMIA NEONATORUM.

Cases.	*History.*	*Condition.*	*Treatment and Result.*	*Mic. Examination.*
1	T. V., aged 6 days. Both eyes sore since 3 days after birth. Mother had a purulent discharge during her pregnancy, father had gonorrhœa 3 months prior to his marriage, but was cured in 2 months. So he says he was well when he married.	Lids swollen, marked chemosis of ocular conjunctiva, profuse discharge of pus from both eyes, cornea clear.	Nitrate of silver gr.x–℥j twice a day, neutralized, boric acid gr.x–℥j to keep the eyes constantly clean, ice cloth, bichloride vaseline $^1/_{10000}$ to the eyelids. Discharged in five weeks, right cornea clear, left opacity.	Gonococci in the eye secretion, also in the mother's lochia.
2	S. P., aged 5 days. Both eyes sore, affected 2 days after birth. Mother a prostitute, had gonorrhœa about twice, and got it again when she was in her third month of her pregnancy.	Lids very swollen, marked chemosis of ocular conjunctiva, profuse discharge of pus, cornea clear.	Nitrate of silver gr.x–℥j twice a day, neutralized, boric acid gr.x–℥j to keep the eyes constantly clean, ice cloth, bichloride vaseline $^1/_{10000}$ to the eyelids. Discharged in five weeks, both corneæ clear.	Gonococci in the eye, secretion, also in the mother's lochia.
3	P. D., aged 6 days. Infant's eyes sore since 2 or 3 days after birth, mother not married, she says she never had gonorrhœa, but had since the second month of her pregnancy a profuse purulent discharge.	Lids swollen, chemosis of ocular conjunctiva, profuse discharge of pus, cornea clear.	Nitrate of silver gr.x–℥j twice a day, neutralized, boric acid gr.x–℥j to keep the eye constantly clean, ice cloth, bichloride vaseline $^1/_{10000}$ to the eyelids. Second week right cornea slightly steamy. Used atropine, but gradually improved. Discharged in five weeks, right cornea, slight opacity, left clear.	Gonococci in the eye secretion, none in the mother's lochia.
4	C. B., aged 5 days. Eyes sore since second day after birth. Mother had a purulent discharge during her pregnancy. Father had gonorrhœa, and at present the gleet. The previous child two years ago had ophthalmia neonatorum. Both eyes lost with leucoma. Mother died during an operation for salpingitis about 5 months after her confinement.	Lids very swollen, chemosis of ocular conjunctiva, discharge of pus. R. C. clear, L. C. steamy.	Nitrate of silver gr.x–℥j twice a day, neutralized, boric acid gr.x–℥j, to keep the eyes constantly clean, ice cloth constantly except at midnight. Bichloride vaseline $^1/_{10000}$, atropia to the left eye. Discharged in six weeks. R. C. clear, L. C. opacity.	Gonococci in the eye secretion and also in the lochia.

5	L. R. aged 1 week. Eyes affected 3 days after birth. Mother had a yellow discharge from the vagina for 4 months prior to her confinement. Mother multipara. Previous children healthy. Could not get history from husband.	Lids very swollen, slight chemosis, profuse discharge of pus. R. C. steamy, L. C. clear.	Nitrate of silver gr.x–℥j, bichloride sol. $^1/_{10000}$ to keep the eyes constantly clean, ice cloth, bichloride vaseline $^1/_{10000}$, atropia to L. E. Discharged in six weeks. R. C. clear, L. C. opacity.	Gonococci in the eye secretion, not found in the lochia.
6	W. McC., aged 10 days. Eyes affected second or third day after birth. Mother multipara. Previous children healthy. She always had more or less leucorrhœa, and would get worse when she became pregnant and especially the later month. Father had gonorrhœa 3 or 4 times before he was married.	Lids swollen, chemosis of ocular conjunctiva, profuse discharge of pus. R. C. clear, L. C. steamy.	Nitrate of silver gr.x–℥j twice a day. Bichloride sol. $^1/_{10000}$, ice cloth constantly applied, bichloride vaseline $^1/_{10000}$, atropia gr.j–℥j to left eye. Third day the R. C. was also steamy, and an ulcer formed on the left eye. As it was on the periphery of the cornea used eserine. For the right eye atropia. Fourth day discharge has diminished somewhat, but ulcer in L. E. perforated. Continued the same treatment except the ice cloth. Discharged in six weeks. R. C. slight opacity, L. C. small leucoma.	Gonococci in the eye secretion, none in the mother's lochia.
7	C. D., aged 9 days. Few days after birth eyes affected. Mother had 3 children. The first child's eyes healthy, second child had ophthalmia, and also the last one. Mother had the whites, which got worse during the later month of her pregnancy. Father refuses to give history.	Lids swollen, chemosis of ocular conjunctiva, profuse discharge of pus. R. C. clear. L. C. a central ulcer.	Nitrate of silver gr.x–℥j, neutralized, bichloride sol. $^1/_{10000}$ to keep the eyes constantly clean, bichloride vaseline $^1/_{10000}$, ice cloth for the right eye, and atropia for the left eye. Second day, ulcer L. C. perforated. Stopped atropine, the same treatment continued. Fifth day, discharge diminishing. Discharged in six six weeks. R. C. clear, L. C. leucoma.	Gonococci in the eye secretion, none in lochia.
8	T. C., aged 8 days. Three days after birth right eye and the left eye on the fourth day became affected. Mother had leucorrhœa; not married, so could not get history of father.	Lids very swollen, chemosis of ocular conjunctiva, great injection of conjunctival vessels. Both corneæ steamy.	Nitrate of silver gr.x–℥j, neutralized, bichloride sol. $^1/_{10000}$ to keep the eyes constantly clean, ice cloth. Second day the discharge was not so profuse. Third day ulcer formed on both corneæ. Stopped the ice cloth and used atropine. Fifth day L. C. ulcer healing, R. C. perforated, discharge greatly diminished. Discharged in five weeks. R. C. leucoma, L. C. central opacity.	Gonococci in the eye secretion. Patient refused to have lochia examined.

9	C. M., aged 6 days. Eyes affected 3 days after birth. Mother primipara; she had the whites off and on for years, but when she became pregnant she had a yellowish discharge, which gradually got worse during the later months, so that she had to be treated for it. Father had gonorhœa several times, and had it at this time; but he says since he got it, he had not had any connection with his wife.	Eyelids greatly swollen, chemosis of ocular conjunctiva, conjunctival injection, profuse discharge of pus. Both corneæ clear.	From the day the eyes were affected, they were intelligently treated by Dr. Upman, who called me to take charge of the case. Used the same treatment as the above cases. Discharged in five weeks. R. C. slight opacity, L. C. clear.	Gonococci in the eye secretion, also in the mothers lochia, and father's urethral discharge.
10	C. L., aged 2 weeks. Eyes affected the third day after birth. Mother had three children, none had sore eyes except the last one. Mother had leucorrhœa, and would always get worse the last of her pregnancy. Could not get history from the father. Treated with tea leaves, salt water, etc.	Eyelids greatly swollen, chemosis and injection of ocular conjunctiva, profus: discharge of pus. R.C. ulcer, L.C. very steamy.	Treatment the same, except for the R. E., used eserine; L. E., atropine. Third day discharge diminishing, but ulcer perforated; L. E. ulcer formed. Discharged in six weeks. Right leucoma adhærens, L. C. opacity.	Gonococci in the eye secretion, none in the mother's lochia.
11	F. R., aged 10 days. Eyes affected third day after birth. Mother primipara; had leucorrhœa, but from the sixth or seventh month had a profuse discharge. Husband says he never had gonorrhœa. Treated with breast milk, tea leaves, bread poultices, etc.	Eyelids swollen, slight chemosis of conjunctiva, profuse discharge of pus. R.C. steamy L.C. ulcer.	Nitrate of silver gr.x-℥j, neutralized, boric acid gr.x-℥j to keep the eyes constantly clean, bichloride vaseline $^{1}/_{10000}$ to the eyelids, ice cloth to R. E., atropine for both. Second day R. C. ulcer forming, L. C. perforated, but the discharge greatly diminished. Same treatment continued, except the ice cloth. Discharged in three weeks. R. C. opacity, L. C. leucoma adhærens.	No gonococci found in eye secretion or lochia.
12	G. P., aged 12 days. Eyes affected third day after birth. Mother had 6 children, none of them had sore eyes. Mother had leucorrhœa once in a while. Husband says he had never had gonorrhœa. Previous treatment, tea leaves, sugar, and water.	Eyes swollen, ocular conjunctiva injected, discharge of pus. L. C. slightly steamy, R. C. clear.	Treatment the same as the previous one. Second day discharge greatly diminished. Continued the treatment the same, except nitrate of silver gr.v-℥j. Fifth day discharge stopped. Same treatment continued, except nitrate of silver. Discharged in 2 wks. Both corneæ clear.	No gonococci found in eye secretion.

13	J. F., aged 1 week. Three or four days after birth eyes affected. Mother primipara. She says she never had any discharge or whites. Husband could not be seen. Previous treatment, breast milk, tea leaves.	Eyes swollen, conjunctiva injected, discharge of mucopus in abundance. Both corneæ clear.	Treatment the same as the previous one. Third day discharge greatly diminished. Continued the same treatment, except the nitrate of silver gr x-ʒj. Fifth day no discharge. Continued treatment Eighth day the child died with bronchopneumonia.	No gonococci found in eye secretion or in the mother's lochia
14	T. K., aged 12 days. Few days after birth both eyes affected. Mother had 8 children, none of them had sore eyes except the last one. Could not get any further history on account of mother not able to speak English.	Eyes swollen, ocular conjunctiva injected. Discharge of pus. Both corneæ clear.	Treatment same as above. Second day discharge greatly diminished. Fourth day no discharge. Continued the same treatment. Twelfth day both corneæ clear.	No gonococci found in eye secretion.

Treatment.

We all know that the chief thing is to keep the eyes constantly clean, with a non-irritating solution, but it is very important to show the mother of the child, or nurse, how to clean the eyes,—if they do not know how, they leave pus behind and injure the cornea in their attempt to clean it. The use of the ice cloth should also be taught, and it should be applied constantly, unless an ulcer is formed on the eye. Atropine should be used when the cornea becomes steamy or a central ulcer forms. Eserine should be used only when a peripheral ulcer is formed on the cornea.

Nitrate of silver, gr.x to ʒj, neutralized with the salt solution, should be used twice a day by the physician, and never should be entrusted to the nurse or mother. Its strength should be gradually diminished, and its application not be stopped for about a week after all discharge has ceased.

TREATMENT OF CERTAIN CORNEAL LESIONS BY HYDRAULIC CURETTING WITH SUBLIMATE SOLUTIONS.[1]

BY THOMAS H. PLEASANTS, M.D., HELENA, MONTANA.

IN RESPONSE to a kind invitation from the Secretary of this Association, to prepare and read a paper upon some appropriate subject, and appreciating the fact that each one of us, perhaps, at some time during our professional career, has had a case of corneal ulcer or abscess, which has persistently resisted every effort on our part to bring about a condition of satisfactory resolution, and where every remedy applied only seemed to add fuel to the fire, I have thought that it might not be wholly without interest to report my experience in the treatment of these cases, by a method the description and technique of which, I will attempt to set forth in the following pages of this article.

I know of no subject which is so full of interest, both to the physician and the patient, as the subject of corneal lesions and their proper and improper treatment. It seems to the patient on the one hand, a life of happiness and usefulness; on the other, a life of woe and despair. To the physician, on the one hand, the proud consciousness of having given to his patient the benefit of a treatment which results in preserving his sight to him, the dearest thing on earth, and on the other, the everlasting reproach of conscience for not applying a certain treatment, if such is known to possess a specific virtue in excess of any other known treatment, thereby entailing upon this patient, a life of untold distress, which, under certain conditions and circumstances is intensified many times over.

If a physician knows of a remedy that will bring about better conditions than those remedies which have heretofore been used in the treatment of corneal lesions, and with results anything but always satisfactory and uniform, then it becomes his solemn duty to suffering humanity to herald to the world

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that remedy, no matter what it may be, or however indifferently he may convey his knowledge of the remedy to others, so long as it can be demonstrated to be a decided benefit and improvement over other already known methods of treatment. Since the first case upon which I used the method of treatment under consideration, I have yet to record a single failure to discharge a patient with other than good and useful vision, but I hope I will not be misunderstood in making this statement, to claim that any and every case will be restored to perfect vision, no matter how extensive the ulcer, or how large the abscess. I can never cease to regret the fact that I was unfamiliar with "hydraulic curetting," when, three years ago, a patient with an infected trachomatous ulcer of the right eye applied to me for relief. After making a thorough examination of the case, I was satisfied that I had a serious trouble to deal with and one which held out little hope for the welfare of my patient's sight in that eye. I used faithfully and in rotation, every known remedy which had ever been advocated, except the one remedy which forms the subject of this article. Result: Total loss of sight in the eye with a dense leucoma and anterior synechia. I felt lucky in not having to remove the globe for panophthalmitis.

During the past eighteen months, I have been called upon to treat many cases of corneal lesions with results so eminently satisfactory, both to myself and to the patients, that I feel constrained to report at least three of the cases which were treated by hydraulic curetting with sublimate solutions. In the September number, 1895, of *Annales d'Oculistique*, page 198, is an article entitled "Hydraulic Curetting of the Cornea," contributed by Dr. Santarnecchi, of Cairo. In this article, the author goes on to say that out of every one hundred cases of ocular diseases in and about Cairo, about seventy cases have some form of corneal lesion, and frequently a very severe type, and he describes briefly the different methods of treatment as applied to corneal ulcers and abscesses, which have been in vogue at different periods. He discusses keratotomy as proposed by Saemisch, its advantages and disadvantages. The actual cautery, which, in the general enthusiasm attendant upon its use, supplanted Saemisch's keratotomy for a time, but which is being relegated to oblivion, owing to its disastrous effects when the ulcer is at all large, because it so often de-

stroys the healthy as well as the diseased tissue, and leaves behind an indelible stigma. "Another method then," he goes on to say, "is necessary which will be less disturbing and less dangerous for the patient," and which, quoting Dr. de Wecker, "will substitute for an ulcer, the walls of which are infected and invaded with micro-organisms, a wound in healthy corneal tissue, which an occlusive and aseptic dressing will guarantee against new infection. Such a result may be expected with greatest confidence from curetting; but Dr. de Wecker himself states that curetting alone is not sufficient, and that it should be followed by energetic irrigation to remove the portions of infected tissue which the most careful curetting will not carry away." Dr. Santarnecchi then goes on to describe what he calls *hydraulic curetting*. He uses a syringe holding, say, one ounce, and fitted to the syringe is a fine nozzle, which I should judge is of about the same calibre as that of an average size hypodermic needle. The syringe is filled with a one to one thousand sublimate solution. After first instilling several drops of a one per cent. solution of cocaine into the eye, and waiting a sufficient time for its anæsthetic effect, he separates the lids as widely as possible, and, directing the jet of sublimate solution against the ulcer or wall of the sbscess, gradually increases the force of the stream until the last portion of adherent ulcerated tissue is removed. He takes the precaution to instill a few drops of atropine rolution in suspicious cases—that is, where he has reason to believe that the iris is involved, or in those cases where the opacity of the cornea is so great as to render it difficult for the surgeon to ascertain the exact condition of the iris. Bearing in mind the case of infected ulcer of the cornea which I have mentioned, and the destruction of sight which followed, I determined to use this method of treatment—namely, *hydraulic curetting*, on the next case that presented itself, which seemed a suitable one for the treatment.

On December 1, 1895, T. M. sent for me to see him at the "Sisters' Hospital" of this city. On examination I found that his left eye had been destroyed from injuries, which he stated, were received during the Civil War. His right eye was constantly congested, and exceedingly painful. In the inner and lower quadrant of the cornea was a large ulcer, which was bulging and the anterior chamber contained pus,—about one large drop. The pupil was very small and photophobia exces-

sive. His history was about as follows: A sheep herder by occupation; about 60 years of age, and of intemperate habits. About two weeks prior to the time I first saw him, he was attending to his duties—herding a band of sheep, when there came a wind storm. Dust or some other foreign body entered his eye. That night he suffered great pain, and it increased the following day. It became so severe that he went to White Sulphur Springs for the purpose of getting something to relieve him. He was given some sort of powder, as he says, to have blown into the eye. Not experiencing any relief from this remedy, he came to Helena. He saw a physician here who gave him some eye lotion to use as directed. He still suffered pain, but continued to use the treatment for a week or ten days. At the end of that time he was persuaded to have me see him and prescribe for him. I saw him, just as stated, and found his condition as described above. His was a case where injudicious treatment meant total blindness. I must confess that I felt like turning the case over to some one else, because I was almost certain that he would lose his sight, but I went to work to improvise a syringe, and fitted a hypodermic needle in it so that the stream would be small, and with this instrument, filled with a one to one thousand solution of bichloride of mercury, I succeeded in thoroughly cleansing the surface of the ulcer from all dead tissue. There were moments when I was in dread of breaking through the thin membrane with this stream, but I did not, fortunately, and after instilling a few drops of four grain atropine solution, I closed the eye, and sealed it with an antiseptic dressing. Ordinarily, we would expect to find, on examination of the next day, very considerable reaction from the irritasion of a 1 to 1000 bichloride solution. As a matter of fact, however, there was very little. The conjunctiva was slightly puffed, and the patient stated that he had suffered very little pain following the operation. There was a very marked general improvement in the eye and the condition was so much better than I had any hope of finding it, that I was quite delighted, but was almost afraid as yet, to put much faith in the treatment. However, I repeated the operation of the day before in every detail, and on the third day I noticed that the hypopyon had diminished one-half, and the pain in the eye had entirely disappeared. Now it was that I began to have hope. On this third day of treatment, instead

of using the sublimate solution, I used a saturated solution of boric acid. I did so more because Dr. Santarnecchi advised doing so, than for any other reason, but on the fourth day, no ground having been lost, I again used the sublimate solution, but this time it was a reduced strength, 1 to 1500. On the fifth day the hypopyon had disappeared entirely and I noticed numerous minute bloodvessels creeping towards the surface of the ulcer—the repair bloodvessels. From this time on the recovery was uneventful and rapid. The cornea cleared up, the engorged bloodvessels of the conjunctiva began to be emptied out, and a general clearing up of all the tissues of the eye took place. At the end of twelve days I discharged the patient with vision $^{20}/_{XL}$. I will state that this man had had, on several occasions (the last one previous to this, three years ago), attacks of inflammation in his eye, and I discovered that it was a plastic iritis, which left the iris adherent to the lens in several places. He denied strenuously ever having had syphilis.

The second case is somewhat different from the foregoing, but the treatment was just the same. D. M., aged 42 years, applied to me on February 28, 1896, for treatment. He is a miner by occupation and stated that three or four days before coming to see me, he had been struck in the eye with a piece of quartz or steel, he could not say which; that he did not pay much attention to it at first, but his eye gradually commenced to hurt him and it finally became so painful that he had to give up work and seek relief. Upon examination, I found in the center of the cornea of the left eye a grayish looking ulcer, and surrounding it in every direction was a milky infiltration between the layers of the corneal tissue. He was suffering greatly and was unable to open his eye without feeling great distress, and his vision was reduced to less than $^{20}/_{CC}$. I was satisfied that I had on my hands the beginning of a case of corneal abscess. I instilled a few drops of cocaine solution, four per cent., and then proceeded to apply the hydraulic curetting, using in the syringe a 1 to 1000 sublimate solution. The corneal tissue at the point where the injury was received was soft and pulpy. I succeeded in removing all of the soft dead tissue and applied an antiseptic dressing and bandage on the eye, telling him to return on the following morning. What was my surprise and delight to find that the milky appearance of the cornea had almost entirely disappeared, and that the sight was so much

improved that he could distinguish at twenty feet letters in the second line of test type, and that he practically had no pain at all. The treatment was repeated twice more, under strict antiseptic precautions, and to make a short story still shorter, on the fifth day he was discharged from my care with but the faintest opacity. I saw this patient a month later and the opacity had entirely disappeared.

On October 7, 1896, Christian H., a machinist, came to my office in a state of great physical suffering and also mental distress. He said that while at work in the shop the day before, a particle of steel or iron had been thrown against the left eye with great violence, but that after suffering a slight momentary twinge of pain, he went to work until it was time to quit, being then nearly 6 o'clock. When he reached his home, however, the pain returned, and in spite of soothing applications of first one kind, then another, it continued to grow rapidly worse, and he spent the night mostly in walking the floor, and when morning came, he was at my office bright and early. Before describing his injury, received the day before, and for which he sought my services, I will state that two weeks previous he received an injury, almost identical in every detail, only it was in the right eye. He received attention from another physician in the city, who gave him the usual routine treatment, but the wound evidently became infected, for his sufferings were excessive and his cornea, surrounding the point of injury, which was in the center of the pupillary area, was so very much infiltrated and hazy, that he was unable to see any letter on the card of test type, even the outline was totally invisible. The pain had been continuous, and was still present when I examined him. At the exact spot where the foreign body struck the cornea, there was still an open ulcer, which was small, about the size of a millet-seed, but which was covered with a soft, pulpy deposit. My reason for describing the first injury will become known presently, because I desire to use it in drawing a comparison on the results of different treat ments used in the two eyes. Now for the injury to the pupillary area of cornea of the left eye. Upon examination, after first making two or three instillations of a four per cent. solution of cocaine into the conjunctival sac, for the pain and photophobia were very great, I found lodged in the center of the cornea, a black speck, which proved to be firmly implanted when I at-

tempted to remove it, and after removal, I made a more critical examination of it and found it to be a speck of iron, and the corneal tissue underneath where it had lodged was found to be burned, showing that the speck of iron was very hot when it struck the eye. With a spud I removed as much of the burned tissue as I dared to, and I then proceeded to use the bichloride of mercury solution, directing the stream with very considerable force against the portion of cornea which was affected by the foreign body, until I was satisfied that I had removed every possible source of infection. I then introduced a few drops of a two-grain solution of atropine and a four-grain solution of cocaine, each of which was dissolved together in a saturated solution of boric acid once more. There was for a few minutes a very sharp pain following the use of the bichloride solution, but it subsided entirely inside of a half hour. I then repeated the operation of "hydraulic curetting" on the right eye, using the bichloride solution as I had just done in the left eye; I kept it up until I had thoroughly cleansed the surface of the ulcer, already described, and after using atropine in this eye also, because there was very sharp pain in the ciliary region below, when I made moderate pressure upon the globe. I bandaged both eyes, after first rendering the region around the eyes, as well as the inside, perfectly aseptic, and took him home. I saw him next day. He passed a painless day and night, sleeping a great part of the time, and when I removed the dressings I found everything as perfectly satisfactory as one could reasonably wish. I re-applied the dressings as on the day before, only using a little hot boric acid solution outside and the atropia and cocaine solution inside. The next day, upon visiting him, he stated that there had still been no pain whatever, and that he could not see why I should keep him shut up in the house when he had so much work on hand that ought to be done. After a little persuasive eloquence, I managed to get him to look at the matter in its proper light and remain quiet at home until I was satisfied it was safe for him to go out. There being a little soft grayish tissue still left on each eye at the point of injury, for safety, I used a 1 to 3000 solution in the syringe, applied as usual, and dressed as on previous day. This was all that I did in the way of curetting. His vision to-day is $^{20}/_{XX}$ in each eye.

In reporting the three cases, I have selected them from

the whole number treated, as fairly representative of the several classes of corneal injuries, to which I have applied this treatment, and I have tried to keep within bounds and not prolong their recital unduly, at the same time give a fairly lucid description of the cases and their progress under treatment. I desire particularly to disclaim any credit for originality in the matter of treatment, because to Dr. Santarnecchi, of Cairo, alone is the honor to be ascribed. I am only a humble disciple, but I do desire to proclaim to the world in stentorian tones, the fact, that, so far as my experience, covering a period of over eighteen months, in the application of this method of treatment is concerned, *no remedy*, nor the *method* of *applying any remedy*, for the treatment of corneal lesions has ever been advocated, in my opinion, that can *begin* to show the percentage of perfect results as the "treatment of certain corneal lesions with sublimate solutions" can show, and I will feel particularly gratified if the profession at large will use it oftener, instead of prescribing a bottle of eye lotion, and let the patient take his chances on the general result, as has so often been done, to the detriment of the patient's sight.

SYPHILITIC AMBLYOPIA.[1]

BY ROBERT F. LE MOND, A.M., M.D., DENVER, COL.,

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THE title of this paper is not a familiar one from the fact, possibly, that there is not sufficient clinical evidence to warrant a separate and distinctive designation. Yet we know that such a thing does exist though, like many other troubles, for instance, exostosis of the orbit and vitreous cysticercus, it is met with very rarely. I have looked up the literature of amblyopia pretty thoroughly and have concluded that syphilitic amblyopia is entitled to a place in our text-books, along

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with the congenital, alcoholic, hysterical and other varieties. I hope that, after I get through reporting a case which I treated in 1895, the members of this distinguished body will readily agree with me that my subject is not a misnomer.

A gentleman, Mr. J., came to me in November, 1895. His age was 58, his occupation that of a railroad engineer. He was a strong, robust man, 5 feet, 8 inches tall, weighing 175 pounds, and full of life and vigor. He told me that seventeen years ago his vision began to fail gradually day by day, until he was forced to give up his position; and, at this time, he had to have an attendant with him to see that he did not stray into by-ways, off of the sidewalk, and in the way of cars, vehicles, etc.

On examination I found the field of vision considerably contracted in both eyes, especially on the temporal side. He still had sufficient sight to distinguish doors and windows without trouble. His vision was: O. D., V. $= {}^{2}/_{cc}$; O. S., V. $= {}^{1}/_{cc}$. Color perception was very much impaired for both green and red, and blue could not be told from black. The ophthalmoscopic findings were nearly negative. The retina was of a pale, dim, lifeless hue, as if viewed through a veil. The fovea centralis could hardly be discerned. The retinal bloodvessels were extremely contracted. The vitreous appeared clear and quite free from coloring matter of any kind. The lens looked a little dull on the posterior surface, but otherwise normal, as was also the cornea. The iris reacted to light, but very poorly.

I inquired particularly as to a syphilitic history. The patient could give but little information on this point. He said he had possibly been a little wild in his youth, and about the time that he was grown he had quite an eruption appear over his body; but he was treated for it by a good physician and it soon disappeared. He told me that he had been treated at different times by several different oculists, but without benefit, and he had concluded to seek relief in New York or Boston; but decided to give the West one more chance, and so came to me. I told him I would treat him two weeks, at the end of which time, if I found him getting no better, I would not hesitate to tell him so; and that I thought the outlook was anything but encouraging.

I suspected that his trouble was of syphilitic origin and put him at once o the following tteatment:

(1) ℞ Potass. iodidi, - - - - ℥iij.
Hydrarg. corrosiv., - - - gr.j.
Aquæ dest. - - - - ℥iij.
M. Sig.—℥j t. i. d.

(2) ℞ Strychniæ sulph., - - - gr.$^{1}/_{30}$.
(Triturates) No. xxx.
Sig.—One tab. t. i. d.

In addition to this I used the positive galvanic pole of eight cells five minutes in each eye, once a day. I continued to increase the iodide until he was taking 150 grains a day, and also the bichloride up to three-twentieths of a grain a day; and the strychnia I increased to three-twentieths of a grain a day. At the end of two weeks he was so much improved under this course of treatment that he did not any longer need an attendant. At the end of two and one-half months his vision had risen to $^{20}/_{XVI}$, and my assistant began to give him a daily lesson in the alphabet, as he had forgotten his letters. We continued thus for six weeks longer, by which time the patient could see sufficiently well to easily recognize ordinary newspaper print, with his error of refraction corrected, which was a + 5.00 D. s. After wearing these glasses for some two weeks with no apparent difficulty whatever, and his vision holding up quite well, I then dismissed him.

This being such a rare and interesting case, in my opinion, I thought that possibly it would prove to be so to the other members of my profession; and, when I received a letter from the Secretary of this distinguished body several months ago, requesting me to read a paper on this occasion, I could not think of anything that I could produce that would be more interesting than the above case which I decided to call syphilitic amblyopia.

SOME OF THE PHYSIOLOGICAL FACTORS CONTRIBUTING TOWARDS MAKING THE EYE EMMETROPIC.[1]

BY E. S. HEISIG, M.D., HOUSTON, TEXAS.

THE subject that I wish to present to your attention today is, "Some of the Physiological Factors Contributing Towards Making the Eye Emmetropic, and What the Exaggeration or Insufficiency of Such Physiological Action Results in, or Excessive or Insufficient Physiological Action Regarded as a Probable Frequent Cause of Ametropia."

You will please take especial notice that I say "probable frequent cause." I do this purposely as what I shall endeavor to present to you I can hardly consider as absolutely proven. The main facts from which my deductions are drawn, are, of course, taken from various sources, the statement of these facts being made in connection with different subjects pertaining to the eye, often in quite an incidental way. My part has been to gather these facts together, and to show the relation existing between them, thus aiding, I hope, toward building a complete structure out of parts which until now, according to the best of my information, have remained isolated facts. It is this relation then of the various facts and the resulting theory that can only be here called in question as it is these alone for which I claim to be mentally responsible.

My taking a subject that is usually considered as belonging to one of the great specialties, I trust, needs no apology. If, however, one is needed, I find it is the very fact, that being no specialist I could hardly presume to offer this paper to a body whose members had made a special study of this organ, and who would therefore be calculated to have given this subject more thought than I have. As I could hardly then presume to treat of this subject before a body of oculists, I must either keep my ideas to myself or present them to physicians in general. So that the only further excuse necessary at all is to justify a general practitioner treating of a special subject. I suppose a sufficient excuse might be "that this is a

[1]Read by title before the South Texas Medical Association

free country," but a better one is to be found in the indisputable fact, that the general practitioner is forced to make all specialties his, and to be prepared to deal with any of its subjects.

With these preliminary remarks, I shall, as briefly as possible, state my theory and reasons for the same. To the laity, and probably to some few physicians who may not have given the subject much thought, it may seem "perfectly natural," to use a common expression, perfectly simple, to be more accurate, for the great majority of eyes to perform their function perfectly, or at least practically so. This however to all who are conversant with the details of the mechanism of vision, to say nothing of the psychical element, is not so self-evident. And the more one understands of the subject, the more amazed one is to find such perfect adaptability and construction of the organ in question. Leaving out in this place the part which the nervous system plays, we shall confine ourselves to the comparatively simpler mechanism of the eyeball viewed as a camera.

We know that the ideal eye is so constructed that when the organ is at rest, *i. e.*, when its accommodation is not brought into action, parallel rays of light will be accurately focused on the retina, or to be more explicit, on the fovea centralis. The eye is then said to be emmetropic. When this is not the case, the eye is said to be ametropic, and may be either hyperopic, myopic, or astigmatic. Not to go into minute details it suffices to observe that one of the essential requirements of the emmetropic eye is, that the refractive power of the eye sustain the proper relation to the length of the axis, *i. e.*, the anterio-posterior diameter of the eyeball, any disproportion between the two, such as the axis of the globe being the slightest fraction of an inch either too long or too short in proportion to the refractive power, or *vice versa*, causing ametropia.

How this state of the perfect adaptability of the refractive media to the antero-posterior diameter of the globe is brought about is, I believe, the key to the solution of the problem as to the chief causes of ametropia, and especially to that form in which the axis of the eye is too long in its relation to the refractive media.

To pursue this investigation we will first try to ascertain

the refractive condition of the eye at birth as compared with that found at a later period. Noyes intimates that great discrepancies exist in regard to this between different authorities and adds that, "The only results which can be considered trustworthy are those obtained under full paralysis by a mydriatic." He then quotes Hansen, who examined 805 children between the ages of 10 and 15 years, in whom this requirement was met by the use of one per cent. hydrobromate of homatropine solution. I take the liberty of copying the same.

Age.	Number.	Average H.	Per Cent. H.
14	134	75 D.	88
13	130	1.00 D.	92 3
12	170	1.25 D.	93.5
11	160	1,50 D.	93 1
10	211	1.75 D.	97.6

The result was, that in 94.4 per cent. there was hyperopia. If we assume this to be practically correct for the ages given, and bear in mind that of those children whose ages were 14, only 88 per cent. were H., while of those 10 years of age 97.6 per cent., or nearly all, were in this condition, we are forced to the conclusion that hyperopia must be the refrative state of the eye at birth in nearly all cases. Hyperopia then must be the rule and enmetropia and myopia the rare exception.

Nettleship says in his work on "Diseases of the Eye" (third American edition, page 329): Hyperopia always dates from birth and does not afterwards increase, except slightly, in old age. But it may diminish and even give place to myopia by elongation of the eye." Dr. Hansen's statistics go to prove that hyperopia *may* not only diminish but that this is the rule as the older the children the less the average degree of hyperopia. That the per cent. of hypermetropes was found less as the ages increased also shows that some must have gotten completely over their hyperopia.

Again, Nettleship says in the same work above referred to (page 324): "Myopia is very rarely present at birth, the elongation of the globe which constitutes myopia comes on gradually during the growing period of life, and especially between the ages of 10 and 20; the eye begins to elongate during childhood. He adds in a foot note on the same page that: "Recent examinations by Schleich and Hermann upon several hundred infants show that the human eye is almost invariably

hyperopic at birth." That the eye is usually hyperopic at birth and becomes less so, or emmetropic at a later period is also supported by the anatomical fact that at birth the eyeball is almost completely spherical while at a later period the antero-posterior diameter exceeds the others by nearly a mm.

Thus Baker in the "System of Diseases of the Eye," edited by Drs. Norris and Oliver, says: "The diameters then (meaning at birth) are approximately equal, the spherical form being more nearly realized, and the child is usually hyperopic." While Noyes in his work gives the following dimensions in the adult as compiled from the highest authorities:

Antero-posterior diameter	. . . .	24.3 mm.
Transverse "	. . . .	23.6 "
Vertical "	. . . .	23.4 "

Which makes the antero-posterior exceed the transverse by 0.7 mm. and the vertical by 0.9 mm. I also quote the following from Fuchs' "Text-Book of Ophthalmology," p. 646: "The shortness of the eyeball, which is the cause of hyperopia, is congenital. Almost all new-born children are hyperopic, their eyes being originally constructed too short in proportion to the refractive power of the media. As the child grows the eyeballs elongate in proportion so that they acquire their requisite axial length and become emmetropic, indeed the elongation may even shoot beyond the mark and pass into myopia. On the other hand, the elongation of the eye may fail to take place to a sufficient degree, so that a certain amount of hyperopia remains during the whole of life."

Now it would not only be interesting, but also instructive, to ascertain the refractive state at a later period of life, say 30 years of age. I find this impossible, however, as I have been unable to find statistics giving the per cent. of persons at this period of life who are emmetropic or otherwise, except that I find that it is estimated that in Germany about 8 per cent. of the entire population are myopic. However, in what has already been said, this has been indirectly anticipated, so that I believe we are justified in assuming that the hyperopia of infancy is in the vast majority of cases only a transient condition—a stage of development in fact, if I may be permitted to use the expression. And this is recognized by the authorities I have already referred to.

Now how is the state of emmetropia brought about?

The correction of hyperopia can be brought about in two ways—either by increasing the refractive power of the eye when in a state of rest, or by permanently lengthening the axis of the globe. Constant (by virtue of spasm) or at least excessive contraction of both the intrinsic muscle, and the extrinsic muscles of the eye, I believe, is amply sufficient to bring this about, the action of the former, perhaps, tending to permanently increase the refractive strength, while the action of the latter, aided by that of the former, is certainly capable of bringing about a permanent increase of the length of the antero-posterior axis of the eye. To explain the *modus operandi* of how an increase of refractive power with the accommotion at rest may be brought about, we might assume a permanent increase in the convexity of the crystalline lens by the constant action of the ciliary muscle whose action as we know normally is to bring about only a temporary increase. It is certainly possible—nay, not only possible, but of everyday occurrence, that an organ held in any position, or in any shape, for a great length of time, retains the position or shape, more or less even after the forces that held it in such position or shape, have been removed. We further know, that the excessive use of a muscle tends towards its hypertrophy, and as in hyperopia the ciliary muscle must be excessively, and almost constantly, used, we should expect to find it hypertrophied, and this competent observers have verified. For instance, Noyes says: "Hyperopia necessitates an effort of accommodation proportionate to its degree, and the result is, that if great, the ciliary muscle becomes enlarged, and in adults its size and contour have a well-marked and conspicuous character. This has been exhibited by Ivanoff." This hypertrophy, it seems to me, should easily enable it in most cases to do its part to further release the crystalline lens so as to enable it to become still more convex in the further effort of accommodation. It may also be possible that as a result of the ciliary muscles being practically in a constant state of contraction this position of the ciliary muscles is permanently acquired irrespective of its contracting properties, so that this position finally becomes the normal one in a state of accommodative rest. Another way in which it is possible, that the refractive power of the eye while at rest may be enhanced, is by an increase of the refractive index of the media, especially

that of the crystalline lens by an increased density or otherwise. But whether this or an increased convexity of the lens as above described really often, or ever, takes place, is merely a matter of conjecture although worthy of further investigation. The other way by which a hyperopic eye may become emmetropic, or even go on to myopia, for that matter, is by a relative increase taking place in the length of the axis of the globe. And this is certainly what essentially takes place, particularly in those cases that go on to myopia.

I may state here that this paper practically only takes into consideration axial ametropia, discarding astigmatism and ametropia due to other causes. It must also be borne in mind that the process of elongation here referred to is not normally a stretching, but a physiological development, simple stretching probably always being pathological.

Let us now consider in what way this is most probably brought about. First, by tbe action of the ciliary muscle and especially by the circular fibers of the same which when brought into excessive and comparatively constant action tend to constrict the circumference of the eye on a plane anterior and parallel to the equator with, of necessity, a corresponding elongation of its antero-posterior diameter. This constriction being prolonged, and comparatively constant, and absolutely so in the case of accommodative spasm, the organ may be thus altered in shape permanently, particularly when aided by the action of the extrinsic muscles, as we shall presently endeavor to show.

Moreover, the action of the ciliary muscle has a stretching effect on the tunics of the eyeball, partly because the globe of the eye being spherical any alteration in its shape making it less like a sphere, lessens its capacity and assuming that the contents remain the same, the area of the tunics must be increased. This action may be said to be indirect, and due, as stated, to the alteration in shape of the organ. In addition to this and probably even more effective in the stretching process are the longitudinal fibers aided by the oblique which draw the coats of the eye directly forward over the contained vitreous.

The extrinsic muscles aid the action of the ciliary muscle in that they too compress the equatorial region of the eye. This is easily understood in regard to the obliques which virtually surround the eye in this region. The recti also compress

the globe by virtue of the fact that both their origins and insertions are limited to a space whose area is less than that of a section of the eyeball made through and parallel with its equator. This being the case the muscles can not take a straight course as their names would indicate, but must curve around the eyeball, for they are inserted anterior to the equator, and upon contracting and straightening bring about a compression of the region between this insertion and the equator.

Now, in the emmetropic condition, when the eye is engaged with distant vision, these muscles are not actively brought into play, because directing the eyes from one distant object to another involves but a small change in the direction of the axis of the eyes which at the same time remain parallel. The acting muscles are also not at the same time antagonized by those of the opposite kind except sufficient to steady the eye, but in hyperopia this is different. An amount of accommodation proportionate to the degree of hyperopia will be necessary for distinct distant vision, and with this there will be a corresponding effort of convergence brought about chiefly by the action of the internal recti, aided by the inferior and superior recti. But as just remarked the axes of the eyes must remain approximately parallel, so that this involuntary effort at convergence must be counteracted, and this is done by a corresponding contraction of the external recti, aided by the obliqui. It will be readily seen then that the chief difference of the action of these muscles on the globe of an emmetropic eye and on that of a hyperopic eye is, that in the emmetropic eye the action is intermittent, and only acted on by one set of muscles, the opposite set only acting sufficiently to steady the eye, hence there being no resistance the eye moves in the required direction instead of being compressed to any extent. In the hyperopic eye, on the other hand, the action is constant whenever vision is exercised, and not only that but the involuntary effort of convergence must be overcome, so that both sets of muscles are acting at the same time, and in opposite directions constituting the most favorable conditions for exercising compression. I may state here by way of parenthesis, that I am strongly impressed with the idea that the whole result of accommodation is probably not effected by the crystalline lens by increased curvature, etc., but that probably at least in some instances a temporary elongation of the eye as

described accompanied perhaps by increased curvature of cornea, etc., helps in the accommodation process. This finds strong confirmation in the case reported by Herbert Harlan, M.D., in the *Journal of the American Medical Association* of November 28, 1896, in which, after the removal of the lens, accommodation to the amount of 2 D. still remained.

[TO BE CONCLUDED IN NOVEMBER NUMBER]

THE OPHTHALMOMETER AS A GUIDE IN SUBJECTIVE OPTOMETRY.

BY GEORGE J. BULL, M.D., PARIS.

IN ALL cases of refractive error it is incumbent on the ophthalmologist to examine for astigmia and to determine its extent when present; for, in the first place, he can not measure the exact degree of myopia or hypermetropia unless he also measures the astigmia; and, in the second place, the astigmia may be the cause of certain symptoms relievable by the use of correcting cylinders.

It is usual to consider the dioptric system of the eye as composed of only three refracting surfaces, the anterior surface of the cornea and the two surfaces of the crystalline lens. Recent researches,[1] however, have shown that a fourth surface, namely the posterior surface of the cornea, has also some importance; for the index of refraction of the cornea differs from that of the aqueous humor more than was formerly supposed. This difference is shown by the fact that the image of a lamp-flame reflected by the posterior surface of the cornea is sufficiently bright to be distinctly visible.

In the present paper, however, I shall use the term "corneal" astigmia only in speaking of the astigmia of the anterior surface of the cornea, measurable by the ophthalmometer, and I shall include under the term "intra-ocular" astigmia that of the three other refracting surfaces,—the posterior surface of

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[1] Tscherning — "L'influence de la surface posterieure de la cornée sur la réfraction oculaire," Bulletin Soc. Francaise, Vol. X, p. 328.

the cornea and the anterior and posterior surfaces of the crystalline lens.

Astigmia of the whole eye—total astigmia as it is called—is the resultant of the special astigmia of all four refracting surfaces, or, in other words, is the resultant of corneal astigmia and intra-ocular astigmia.

To determine the amount of the intra-ocular astigmia, we have recourse to such instruments as Tscherning's ophthalmophacometer. In the year 1891 Tscherning examined my right eye with his instrument and found:

In the anterior surface of the cornea, an inverse astigmia of	0.74 D.
In the posterior surface of the cornea an inverse astigmia of	0.57 D.
In the anterior surface of the crystalline a direct astigmia of	1.09 D.
In the posterior surface of the crystalline an inverse astigmia of	0.95 D.

Taking into account the refractive direction of the principal meridians of the four refracting surfaces he has found the resultant of the four values to be a total inverse astigmia of 1.05 D. Tscherning has examined a few other eyes (one of which differed from mine in showing 2.36 D. of direct astigmia in the anterior surface of the cornea), and has found in all of them that the crystalline and the posterior surface of the cornea produced together an inverse astigmia.

My own experience leads me to believe that this is the general rule; for the comparison of the amount of the corneal astigmia with that of the total astigmia in a large number of cases shows that the difference may be roughly expressed as being equal to an inverse astigmia of about 0.75 D.

Again, if it be true that the total astigmia of the eye is the resultant of an intra-ocular inverse astigmia and of the corneal astigmia, we should expect that the meridian of greatest refraction of the whole eye would not always coincide with the meridian of greatest corneal curvature. My experience justifies this inference.

Moreover, as the addition of two convex cylinders of equal value with a certain angle between their axes produces a combination having its meridian of greatest refraction per-

pendicular to the bisector of the angle, we should infer that an analogous effect would occur in the eye as the resultant of an intra-ocular inverse astigmia and a direct or oblique corneal astigmia, and that if the corneal astigmia be of low degree, the meridian of greatest refraction of the eye will incline more towards the horizontal than does the most curved meridian of the cornea. Experience has shown me that this is commonly the case. It has also shown, as might be inferred from the experiment of adding a strong convex cylindrical glass to a weak one at another axis, that when the corneal astigmia is high the meridian of greatest refraction of the eye commonly coincided with the meridian of greatest corneal curvature.

The instruments and the calculations required to determine directly the degree of intra-ocular astigmia are at present too complicated to allow of their general use in the consulting room. The corneal astigmia can, however, now be measured with quickness and accuracy—thanks to the ophthalmometer of Javal and Schiötz; and the purpose of the present paper is to consider how far the inferences to be drawn from a knowledge of the corneal astigmia are of value in everyday practice.

It is true that the measurements obtained by the ophthalmometer give us figures very different from the total error we are required to correct. I have found, however, that there are a few simple rules by the application of which the measurements of the ophthalmometer may be made to furnish a most useful guide. These rules are the natural sequence of the general considerations as to intra-ocular errors to which I have just alluded.

Speaking broadly, it may be said that the total astigmia is approximately equal to the amount indicated by the ophthalmometer, expressed as myopic astigmia, combined with an inverse myopic astigmia of 0.75 D. From this, and from the considerations already mentioned, it follows that:

1. When the corneal astigmia is direct, and above 1 D. we may expect the total astigmia to be also direct but of lesser amount.

2. When the corneal astigmia is direct and about 0.75 D. we may expect to find almost total absence of astigmia by subjective examination.

3. When the astigmia is direct and 0.25 D. subjective

examination will probably reveal an inverse astigmia of about 0.50 D.

4. When there is no corneal astigmia we may expect to find by subjective examination an inverse astigmia of about 0.75 D.

5. When the corneal astigmia is inverse, we shall generally find by subjective examination a higher amount of inverse astigmia.

6. When the corneal astigmia is oblique and direct rather than inverse, a lesser degree of astigmia will be discovered by subjective examination. The reverse of this is true when the obliquity tends to bring the case into the class of inverse astigmia.

7. When the corneal astigmia is oblique and of low degree, the meridian of greatest refraction of the whole eye commonly inclines more towards the horizontal than does the meridian of greatest corneal curvature.

8. When the corneal astigmia is of high degree, the meridian of greatest corneal curvature coincides with the meridian of greatest refraction of the eye.

The above deductions are of course given only as approximations to the truth. The ophthalmometer should never be considered as a substitute for the subjective method of examination. It should be looked upon as a guide and as a check, enabling us to conduct the subjective examination on logical principles.

The first glance at the images of the "mires" of the instrument as we rotate the arc, shows whether there is any corneal astigmia. The difference of the level of the "mires," or their overlapping, enables us to estimate the amount of error. We see immediately whether the astigmia is regular or irregular; for when the images of the "mires" are of normal shape and of equal size, and when the principal meridians are perpendicular to each other, we conclude that the astigmia is regular. When, on the contrary, the images are deformed or when one is smaller than the other, we know that the astigmia is irregular.

The information given by the ophthalmometer is often more trustworthy and useful than that given by skiascopy or any other objective method of examination, and it is needless to add that the cornea may be measured by the ophthalmo-

meter in cases in which opacities in the media render skiascopy quite impossible. When the corneal astigmia is irregular, the ophthalmometer often enables us to judge of the expediency of endeavoring to correct the error by cylindrical glasses. In this communication, however, I shall not touch upon the services which the ophthalmometer has rendered, and will still continue to render, in the study of the changes in corneal curvature which occur after wounds of the eye, and during the progress of keratoconus, pterygium, etc. I will confine myself here to the practical value of the instrument in cases of regular astigmia.

It is a great advantage to know beforehand the amount of astigmia that we may expect to find. The rules already stated enable us to infer in many cases that the total astigmia does not exceed 0.25 or 0.50 D. Such an inference is often of value. For example, when we consider it in connection with the visual acuity of the patient and with the circumstances and symptoms of his case, we may judge whether it be expedient to determine the exact amount of astigmia by the subjective method. Again, if we are seeking the cause of the bad visual acuity it informs us that astigmia may be excluded, and thus we are helped to find the real cause. It is hardly necessary to add that it saves us from a wearisome and fruitless search with cylindrical lenses.

When, on the other hand, the ophthalmometer shows that we have to deal with a high degree of astigmia, we properly dispense with trials with the weaker cylinders, and in this way gain time, spare the patient fatigue, and greatly simplify the problem which his answers help us to solve. Much might be said on the value of the instrument as a time-saver; but I prefer to call your attention to an advantage which has not to my knowledge been referred to by other writers.

This advantage is that the ophthalmometer enables us to proceed in the different parts of the subjective examination with logical precision and certainty, not so much by indicating the amount of astigmia, as by pointing out the position of the meridian of least refraction.

In considering astigmia we should regard it as being an object of a certain length, which length it is our duty to discover. Now in any of the arts, when it becomes necessary to measure an object the first thing is to determine the position

of one end, and then to ascertain the distance to the other end, taking care that the object does not move during the process of measurement. There is reason to fear that these steps are not always taken in the subjective examination of astigmia.

The object to be measured, the astigmia, is what I have called the "remote zone" of the range of accommodation. The farthest end of this zone is the *remotum* of the meridian of least refraction; the nearest end is the *remotum* of the meridian of greatest refraction. The strength of the cylindrical glass required to bring the two *remota* together gives the measure of the astigmia.

Now the method I have recommended for the subjective examination of astigmia consists of two steps: first, by means of spherical glasses I shift the patient's range of accommodation so as to bring the *remotum* of the meridian of least refracto the test-cards at 5 meters (or a little nearer than the cards), and secondly, by concave cylindrical lenses I carry back the *remotum* of the meridian of greatest refraction till it also rests on the test-cards.

It will be seen that by this method mydriatics are not required; for the fixity of the remote zone which is commonly obtained by paralysis of accommodation is here ensured in another way.

The first step of my method fixes one end of the object to be measured and prevents its moving in a way to mislead me; for if at any subsequent moment during my trials the eye accommodates, the lines which remained distinct on the clock-dial will appear less distinct, and all the other lines will be blurred in proportion; and, in fact, as far as we are aware of it, the eye makes no efforts of accommodation. The lines remain unequal in distinctness until we add the cylindrical glass which corrects the astigmia.

In myopic astigmia it is the common practice of observers to proceed on a plan closely resembling the one I have just outlined. They agree that the determination of myopic astigmia is simple. They first correct the meridian of least refraction by spherical glasses, and then by means of concave cylinders correct the meridian of greatest refraction. Now if they did this in cases of hypermetropic and mixed astigmia, they would not have cause to believe that such cases are especially difficult. Instead, however, of following such a plan in cases

combined with hypermetropia, they take no special pains to distinguish between the two principal meridians, and, not knowing with which they have to do, fail to prevent changes in accommodation which alter the relative value of the radiating lines of the clock-dial. The practical result of this, and of trying now convex and now concave cylinders, is simply to introduce artificial difficulties into the solution of the problem.

By my method, however, the process is exactly the same for hypermetropic and mixed astigmia as for myopic astigmia.

This method which I have ventured to recommend in this and other communications[2] can, like all other subjective methods, be carried out without the aid of the ophthalmometer; but that instrument can easily be made to render a special service in this connection.

The rules laid down in the preceding portion of this paper show that there are inferences to be drawn from the ophthalmometric reading before the patient has been examined in any other way; but other and more important inferences can be made when the ophthalmometric reading is considered in connection with the answers given by the patient during the subjective examination. Perhaps the most important service rendered by the instrument is that it informs us of the position of the meridian of least refraction of the eye and thereby enables us to interpret the answers of the patient in a highly practical way.

The very first statement of the patient in reply to our question as to the relative value of the different radiating lines on the clock-dial often enables us, with the help of the information given by the ophthalmometer, to state with certainty that the case is one of astigmia combined with a considerable degree of hypermetropia. In fact it may be said that the use of the ophthalmometer in connection with my special method of subjective examination makes hyperopic and mixed astigmia often easier of diagnosis than simple myopic astigmia. As this point has not, so far as I know, been made by any writer, and as it shows in a striking manner the practical value of the ophthalmometer, I may speak of it in detail.

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[2]Bulletin de la Soc. francaise d'Ophtalmologie, 1895, p. 399.
Ophthalmic Review, 1895, p. 275.
Archives d'Ophtalmologie, 1866, p. 219.

To make my meaning plain, I may relate a case. Examination of the left eye of Mrs. T. P. H. with the instrument shows a direct astigmia of 3 D. (0+3). The first inference is that the subjective examination will show a direct astigmia of about 2 D. In other words, we infer with certainty that the horizontal meridian of the eye is the meridian of least refraction, and that the patient looking at the clock-dial placed in the remote parts of her range of accommodation will see the *vertical* lines more distinctly than any other. If then, this patient looking without the aid of glasses, tells me that the horizontal lines (and not the vertical) are the most distinct in the clock-dial at a distance of 6 meters, I infer that that distance is not in the remote part of her range of accommodation; or, in other words, that the patient has a considerable degree of hypermetropia.

The diagnosis of hypermetropia might no doubt be made in many such cases from the observation of a high degree of visual acuity without glasses; but the patient's first answer as to the clock-dial in the case mentioned makes the presence of hypermetropia absolutely certain. Moreover, the ophthalmometer here enables me to proceed to the discovery of the correcting glass by rapid steps, passing over the weaker glasses which would only tire the patient uselessly. I begin the examination, therefore, with + 2 sph. With this glass she still sees the horizontal lines more distinctly than the vertical. I therefore use + 4 sph.; vision is much improved thereby and the lines of the clock seem to be all alike. Still guided by the inference drawn from the ophthalmometer, I give + 6 sph. and now, as has been foreseen, the vertical line is distinctly black and the horizontal indistinct. The clock-dial is now, in a word, in the remote zone. I now correct the refraction exactly for the vertical line, and then, add concave cylinders, beginning with — 1.25, till I make the horizontal line as distinct as the vertical. It is clear that the ophthalmometric reading has helped me throughout the examination, enabling me to proceed with logical precision and certainty, instead of groping in the dark. Cases of this kind are not exceptional, but are constantly met with in our daily practice.

Javal and Schiötz have rendered an immense service to practical ophthalmology by perfecting the work of Helmholtz. The value of their instrument has already made itself felt in

all countries where ophthalmology is practiced, but the field of its usefulness has yet to be thoroughly understood and appreciated. It has already contributed much to our knowledge of what astigmia really is; and when time will have allowed us to follow our patients through a longer series of years, we may hope to learn, with the aid of this instrument, something of the influences which bring about changes in the corneal curvature.

In the meantime the ophthalmometer, used in the way indicated, acts as a guide and as a check in the search for the correcting glass; and subjective optometry, no longer a wearisome and blind proceeding, subject to error, is made a rational method, as exact and interesting as any employed in physical diagnosis.

A NEW INSTRUMENT.

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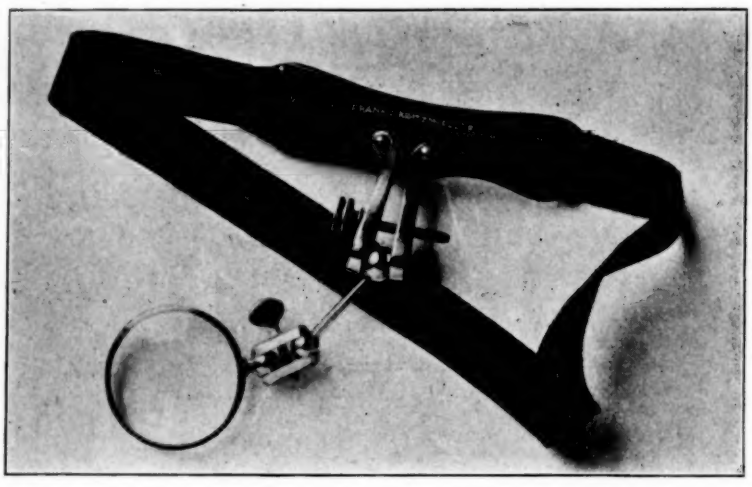
TO HOLD a convex lens so as to make good focal, or oblique, illumination of the cornea and iris necessitates a certain degree of training. Not even every oculist can do it properly. In many instances, for example, I have attempted to remove a foreign body with the aid of such light as a perfect greenhorn in optics was able to throw upon the cornea, and I dare say it is needless to tell anyone of my colleagues what this means to the operator. Then, too, there are times when we have sore need of focal illumination, and no one, neither trained nor untrained, is nigh to help us. With the view to overcoming these difficulties I have devised, and had made, by Messrs. Frank & Kratzmueller, of this city, the appliance shown in the accompanying cut. It consists of an ordinary head-band to which, in lieu of a mirror, is attached by triple ball and socket arrangement, a common loup, or bi-convex lens, whose focal distance is about two and one-half inches. To use the contrivance the patient is seated near the light, as for the usual focal illumination of the cornea, the band is

buckled, or hooked, around his, or her, head (the one in the illustration is wrongly made with an elastic band), with the lens-holder at the temple corresponding to the eye to be operated, and the loup adjusted to throw the light as desired. Slight oscillations of the head may occur without causing the light to dance away.



I find the device most convenient, also, in searching for those extremely fine cilia which we are often called upon to pull out, or to electrolyze, as, the instrument being fast to the patient's head, and the lens focused upon the border of the lid, our movements do not disturb the view.